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The effect of the Goldwater-Nichols Department of Defense Reorganization Act on Tactical Aviation pilot and NFO career paths

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THESIS

THE EFFECT OF THE GOLDWATER-NICHOLS
DEPARTMENT OF DEFENSE REORGANIZATION ACT ON
TACTICAL AVIATION PILOT AND NFO CAREER PATHS

by

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This thesis presents a computer aided analysis of the effects of implementing the requirements of the Goldwater-Nichols Department of Defense Reorganization Act on the career paths of U. S. Navy Tactical Aviation (TACAIR) pilots and naval flight officers. The method of TACAIR community data collation, and the user interactive personnel flow forecasting model, FORECASTER, are thoroughly documented. In the analysis, the FORECASTER model is run through several iterations, each iteration devoted to satisfying the next lower priority billet requirements, beginning with Joint Duty Assignments and ending with "soft" shore duty billets. The effects of each iteration is carefully examined to assess any positive or negative impact on the TACAIR community. The results of this analysis show a deterioration of warfighting skills of TACAIR field grade officers, and a decreased ability to fill "soft" billets from the TACAIR community.

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THE EFFECT OF THE GOLDWATER-NICHOLS DEPARTMENT OF DEFENSE REORGANIZATION ACT ON TACTICAL AVIATION PILOT AND NFO CAREER PATHS

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ABSTRACT

This thesis presents a computer aided analysis of the effects of implementing the requirements of the Goldwater-Nichols Department of Defense Reorganization Act on the career paths of U. S. Navy Tactical Aviation (TACAIR) pilots and naval flight officers. The method of TACAIR community data collation, and the user interactive personnel flow forecasting model, FORECASTER, are thoroughly documented. In the analysis, the FORECASTER model is run through several iterations, each iteration devoted to satisfying the next lower priority billet requirements, beginning with Joint Duty Assignments and ending with "soft" shore duty billets. The effects of each iteration is carefully examined to assess any positive or negative impact on the TACAIR community. The results of this analysis show a deterioration of warfighting skills of TACAIR field grade officers, and a decreased ability to fill "soft" billets from the TACAIR community.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

On 1 October, 1986 Congress passed the Goldwater-Nichols Department of Defense Reorganization Act of 1986. Title IV-Joint Officer Personnel Policy of this Act imposed a requirement on the military services to establish training and education in "the employment/ deployment and support of unified and combined forces." It further required that:

- Each service designate a specified number of billets as Joint Duty Assignments (JDA), of which 50% will be filled by Joint Specialty Officers (JSO) or JSO Nominees.

- Following Joint Professional Military Education (JPME), all officers with the Joint Specialty, and "at least 50 percent of all other officers" "must be assigned to a JDA as their next duty assignment".

- Promotion rates for "officers who are serving in, or have served in, JDAs (other than officers on the Joint Staff and JSOs)" cannot be "less than the rate for officers in the same grade and competitive category".

- Promotion rates for JSOs cannot be "less than for officers in the same grade and competitive category who are serving or have served on the headquarters staff of their armed force." [Ref. 1]

These were the most stringent of all requirements affecting officer career paths and promotion criteria which had been generated external to the services themselves, and the first to address the training and education of officers in joint matters. The services are now responsible for ensuring that they develop a cadre of Joint Specialists and keep them competitive for promotion with their non-JSO counterparts. Additionally, and of great import, is the requirement that this be done without leading to "significant deterioration of warfighting skills or personnel shortages in operational fields" [Ref. 2]. Each service was forced to develop a long range strategy for training, educating, providing experience tours for and tracking the advancement of Joint Specialists. Community managers and detailers are currently in the process of refining this strategy and assessing the impact on warfighting skills and operational billet manning levels.

These events provided the Navy with an ideal opportunity to expand and refine human resource planning in order to develop a strategy which would satisfy the requirements established by Congress while minimizing the negative impact on Navy operations and officer career path structures. This planning would ideally include principles of both manpower planning and organization career management, as defined by Burack and Mathys [Ref. 3].

B. SCOPE OF THESIS

In order to accomplish the main goal of this thesis effectively, that of analyzing the potential effects of the Goldwater-Nichols Act on officer career paths in the Tactical Aviation (TACAIR) community, three prerequisites were identified and accomplished. First, a computer model, FORECASTER, which was obtained to assist in the analysis, was evaluated using software quality criteria. Second, modifications to the model were made to improve it and adapt it for this specific analysis. Third, the data necessary to run the model was collected and structured. The thesis was, therefore, divided into four major sub-areas as follows:

1. Evaluation of current model

Various thesis students working with Professor Paul R. Milch at the Naval Postgraduate School in Monterey have been engaged in the continuing development of Navy officer career path models (see Milch for a review [Ref. 4]). Morris was the first to apply such a model to a Naval Aviation community, namely the Maritime Patrol Aviation community in 1980 [Ref. 5]. Ballew, in his 1984 thesis, analyzed the effects of Permanent Change of Station movements on the career development of Naval Aviation Officers in general [Ref. 6]. In 1988, Milch [Ref. 4] developed a Navy Officer career path model that was further enhanced by Johnson and used to analyze the effect of the Goldwater-Nichols Act on personnel flow in the Surface Warfare community of the Navy, with the intention of providing it for use by the Surface Warfare Officer community manager in the Navy's OP-13 branch of the Office of the Chief of Naval Operations [Ref. 7].

This model was selected for use in this thesis based on its proven capability to provide meaningful analytical results in officer career path analysis with regard to the effects of the Goldwater-Nichols Act. Here, it has been reviewed and evaluated with specific regard to software quality along three criteria: adequacy of documentation, user friendliness, and functionality .

2. Model Modifications

Sections of the program were modified for the following reasons:

- to refine the model for specific analysis of the Tactical Aviation community of the Navy;
- to improve the functionality of the overall program; and
- to increase user friendliness.

3. Collation and Restructuring of Data

The model has been designed to utilize data elements derived from community specific manpower and billet data, and Tactical Aviation Officer career path data.

Restructuring of the data was necessitated by the variance between the data file formats utilized by the Navy, and the data format required by the model. Specifically, within the Department of the Navy, individual officer career data is not collected by tour number, whereas the model utilizes data predicated on tour number.

4. Model Execution and Analysis of Results

Upon completion of compilation and manipulation of data representing the TACAIR community of the Navy, and modification of the model to accommodate the Tactical Aviator's career path, the program was executed to determine the effects of various career path alternatives intended to implement the requirements promulgated in the Goldwater-Nichols Act.

C. METHODOLOGY

1. Evaluation of current model

Using established principles of structured programming, the forecasting model as developed by Milch and enhanced by Johnson was examined with specific attention toward:

- Completeness and logical coherency of documentation
- Simplicity of design
- Modularity
- Structure
- Coupling and cohesion
- Traceability

Initial emphasis was given to review and improvement of program documentation, as the existence of adequate documentation would be critical for effecting program modifications.

The user friendliness of the program was evaluated through observations of trial runs with users who had a degree of computer literacy considered equivalent with that of the ultimate intended user.

2. Collation and Restructuring of Data

The TACAIR community specific data required was collected from the following sources:

- Navy Officer Data File
- Squadron Manpower Authorization OPNAV 1000/2
- Manual of the Navy Officer Manpower and Personnel Classifications
- Perspective (NAVPERS 15892)

Data file sorts were conducted at the Monterey branch of the Defense Management

Data Center (DMDC) through the Navy Officer Data Files to obtain required data. Additional data were obtained through the Tactical Aviation community manager at the Office of the Chief of Naval Operations in Washington D.C..

3. Model Modifications

The model modifications required to obtain results specific to the Tactical Aviation community were restricted to the data sets. The major modification for improvement of functionality was to provide the overall program with the capability to store, import and export multiple data sets. This, along with user data input/update and display formats, enhanced user friendliness.

4. Model Execution and Analysis of Results

Through manipulation of the tour lengths and transition probability data, various options available to effect the implementation of the Goldwater-Nichols Act were developed. These options were evaluated against the requirements to maintain operational manning levels and warfighting skills.

II. FRAMEWORK OF MODEL DEVELOPMENT

A. BACKGROUND OF CURRENT MODEL

In 1988, Milch developed "An Analytical Model For Forecasting Navy Officer Career Paths" which was a mathematical model using Semi-Markov processes [Ref. 4]. This model, coded in APL (A Programming Language), was available for use on the IBM 3033 mainframe at the Naval Postgraduate School using VS APL Release 4 and on personal computers using STSC's APL PLUS software. In 1989, the model was renamed "FORECASTER" and modified by Johnson to provide a user friendly interface in conjunction with his use of the model in the analysis presented in his thesis [Ref. 7].

B. DESCRIPTION OF THE FORECASTER MODEL

The FORECASTER model was provided with minimal documentation. The computational functions coded by Professor Milch contained adequate documentation written into the code, while the interface functions and data files contained no internal documentation. The only external documentation provided was a flow chart designed by Johnson [Ref. 7]. Consequently, in order to develop the thorough understanding of the program necessary to further develop and utilize it, the program had to be analyzed and documented. To this end, the functional hierarchy, shown in Appendix A, and a set of dataflow diagrams, provided in Appendix B, were developed. As can be inferred from the functional hierarchy and the dataflow diagrams, FORECASTER consists of 40 user-defined functions (sub-programs) and nine data files. Of the 40 functions, 31 provide the user interface, and the remaining nine comprise the computational core. These groupings of functions are therefore discussed individually in the following paragraphs.

1. Data Files

The model utilizes nine data files during execution. Generation of each of the files requires specific assumptions to be established which are then utilized as guidelines for model structure and data collation. These assumptions, along with their rationale, and the methodology of data collation, are the foundations for the validity of the results of the model execution. Their importance mandates that they be examined individually in order to provide a complete understanding both of their use within the model and of the nature of the model results.

a. Activities

The community to be modeled must be carefully examined to determine the various activities in which members of the community engage. These activities must then be grouped in a manner that is appropriate for the specific application of the model. Figure 2.1 shows the "Aviation Officer Professional Development Path" [Ref. 8]. The various activities depicted there, in which Aviation officers engage during their career, were grouped into categories of activities. The overriding criterion by which the grouping was decided was the intent of the model analysis: to determine the effects of the Goldwater-Nichols Act on the Tactical Aviator's career path and on the Tactical Aviation community as a whole. The primary distinction made between activities was to categorize them as either "Sea Duty" or "Shore Duty". "Sea Duty" activities are those activities that provide the officer with operational experience. These types of duty in the TACAIR community include deploying squadrons, afloat staffs or as a member of a ship's company. "Shore Duty" activities were then reviewed to determine if the need existed to further categorize them. In order to analyze the community with respect to Title IV of the Goldwater-Nichols Act, Joint Duty Assignments must be as a member of a ship's company. "Shore Duty" activities were then reviewed to determine if the need existed to further categorize them. In order to analyze the community with respect to Title IV of the Goldwater-Nichols Act, Joint

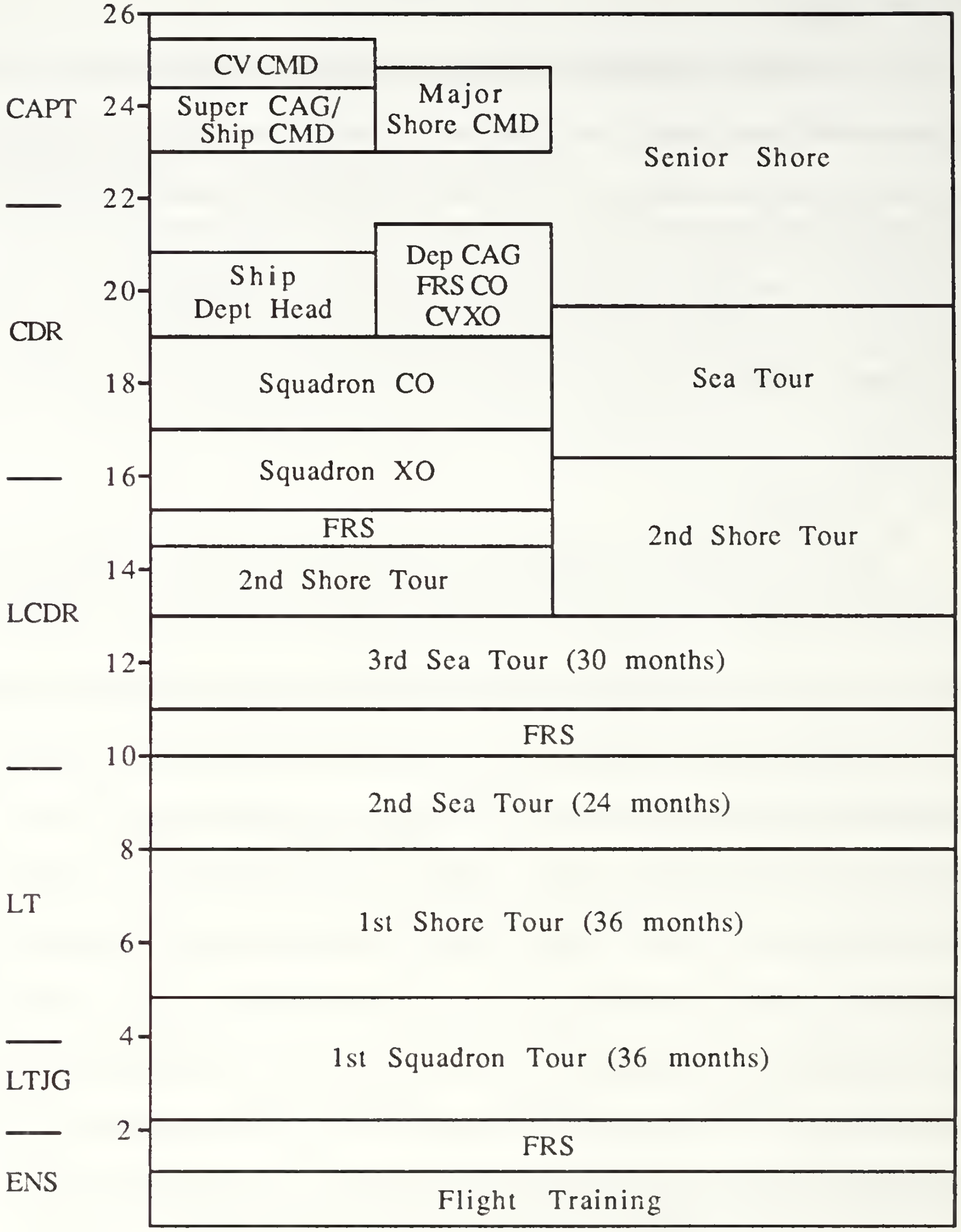


Figure 2.1

Aviation Officer Professional Development Path

Duty Assignments must be separated out to become a distinct activity type. Additionally, attendance at one of the institutions, as delineated in category A in Table 2.1 which results in receipt of JPME credit must also be separated from all other types of shore duty and placed in its own activity type, labeled Joint Professional Military Education (JPME). Finally, attendance at one of the Fleet Replenishment Squadrons (FRS) was also examined. The initial training at an FRS is excluded as it is occurring prior to entrance into the TACAIR community. However, an aviator will likely attend FRS a second time, prior to his returning to a squadron. Even though all aviators in FRS will transition directly into a squadron, this second and perhaps subsequent attendance at FRS has been separated out as a distinct activity in order to maintain a correct accounting of the numbers of aviators in squadrons.

Selection of names for the activities should be a natural extension of constructing the categories themselves. Since the names will identify results on screen displays and printouts, consideration should be given to naming the activities in such a way as to associate them with the specific data set. The categories of activities (hereafter referred to simply as activities) as defined for this application are depicted in Table 2.1.

TABLE 2.1

ACTIVITY DEFINITIONS

A. JOINT PROFESSIONAL MILITARY EDUCATION (JPME): Tactical Aviator billets at the Armed Forces Staff College, Naval War College, Industrial College of the Armed Forces, and USA, USAF, USMC Service Colleges.
B. JOINT TOUR: Tactical Aviator billets designated as Joint Duty Assignment billets.
C. SHORE DUTY: Tactical Aviator billets at naval shore establishments not meeting the criteria of A or B.
D. SEA DUTY: Tactical Aviator billets in a deploying squadron, afloat staff, or in a U.S. naval ship's company.
E. FLEET REPLENISHMENT SQUADRON (FRS): Tactical Aviator billets at an FRS squadron which occur after the 1st Squadron Tour.

b. Tour Number

Each specific activity when executed by an officer constitutes a tour. The TACAIR aviator's first tour, tour number 1, is normally the "1st Squadron Tour" (Figure 2.1). The highest number of tours of any officer in the TACAIR community as recorded in the "Past Duty Station Counter" of the Officer Master File was 11, as can be seen later in Table 2.3, and it provides the second dimension of the data files described in paragraphs c, d, and e.

c. Tour Length

The length of each duty assignment by activity and by tour number must be determined. As an example, sea duty in tour one or two is 36 months long, while sea duty in tour three or four is 24 months long. The unit of time to be utilized in tour lengths must be considered in respect to adequate representation of all tour lengths and in respect to the forecasting horizon desired for the model. For most purposes, using lengths in multiples of quarters is appropriate both for accurate tour length representation and for forecasting. Specific tour lengths were obtained from Figure 2.1, and from OP-13. The resultant data file for tour lengths was a two dimensional matrix of numerical data representing the length of duty assignments at each activity and tour number, shown in Table 2.2.

TABLE 2.2

TOUR LENGTH MATRIX

ACTIVITY	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
JPME	0	0	2	2	2	2	2	2	2	2	2
JDA	0	8	8	8	8	8	8	8	8	8	8
SHORE DUTY	8	10	12	8	8	8	8	8	8	8	8
SEA DUTY	12	12	8	12	10	10	8	8	4	4	4
FRS	0	1	1	1	1	1	1	1	1	0	0
NOTE: Figures shown are calender quarters.											

d. Incumbents

Numerical data for the specific community being modeled of all incumbents in each activity and tour number must be collated in order to provide a "snapshot" of the community at a particular instant of time as the starting point for the model. For the Tactical Aviation (TACAIR) community, the first step was to define the community itself. This was accomplished with the guidance of the TACAIR community manager in OP-13 in the Office of the CNO. For the purposes of this analysis, the TACAIR community was defined as male pilots and flight officers within the grades 01 to 06 (Ensign to Captain) in the following types of aircraft: SH-3, A-4, A-6, A-7, F-4, F14, F/A-18, EA-6, E-2, and S-3.

With the community defined, the next step was to isolate the community specific data in the Officer Master File (OMF). The OMF contains a record of over two hundred fields of data on every active duty U.S. Naval Officer. Access to the OMF was accomplished at the Monterey branch of the Defense Management Data Center (DMDC), which had the complete file as of September of 1988. These files were first sorted using aviation officer designators of 1310, 1313, 1315, 1317, 1320, 1325, and 1327. This resulted in a file of 16,950 Pilots and Naval Flight Officers (NFOs), which compared reasonably against the current estimated aviation community manning of 16,354. The higher figure from the OMF can be attributed to the policy of not deleting an officer's file immediately upon separation from active duty. Officer files are maintained for six months to a year after separation in case the officer re-enters the service. Consequently, all additional sorts on the OMF included deletion of a record if the officer had separated.

The next sort was by Additional Qualification Designator (AQD) in order to separate out the Tactical Aviation community. Using Part C of the Manual of the Navy Officer Manpower and Personnel Classifications [Ref. 9], the AQDs were obtained which were used for documentation of qualification in the previously mentioned aircraft types in the OMF. In order to ensure the correct AQDs were being utilized, a preliminary list of all aviators sorted by AQDs was generated. This provided an overview of the entire aviation community by qualification. Within each officer's record are nine fields for AQDs. The primary AQD should be the aircraft in which the aviator was currently qualified. This primary AQD may, however, indicate that the aviator was an instructor pilot or a student, without indicating the specific aircraft type. Consequently, the sort by AQDs was a multi-step process. First, all aviators with one of the desired AQDs as their primary AQD were acquired. Second, all aviators with one of the desired AQDs as their secondary AQD were acquired. Third, those records acquired based on the second AQD have the primary AQD screened for qualification in an aircraft other than those specified for the TACAIR community. Any such record was removed. This resulted in a TACAIR community population of 7,692.

Once the community was established, and a sub-file constructed of the associated records, these records were then sorted by activity. The initial differentiation between sea and shore duty was accomplished by sorting on the "Type Assignment" code in the "Past Duty Station (Current)" field of the OMF. Aviators in the Fleet Replenishment Squadrons (FRS) are listed in the OMF as being on shore duty and have a special code preceding the "Past Duty Station (Current)", and are therefore easily identified and sorted out. All of the remaining shore duty records were then screened for officers in attendance at one of the colleges providing JPME. Finally, a list of social security numbers of the remaining non-JPME shore tour officers was sent to the DMDC center in Arlington Va., where a cumulative file of Joint Specialists is maintained. There, those aviators who have had Joint Duty Assignments (JDAs) were identified, along with the dates of their assignments. These records were then screened once more to identify the number of aviators currently at JDAs. The JDA total was verified against a list of TACAIR JDA billets which was provided by the TACAIR community manager.

The figures for aviators on sea duty were initially validated by comparison against the total figures required by the Squadron Manning Documents (SMDs), adjusted to current estimated manning levels. However, this was determined to be an improper representation of the actual squadron manning levels required. In order to more accurately determine squadron manning levels, the number of aircraft per squadron was multiplied against the peacetime seat factor for each type of aircraft. This generated a figure used by the community managers, called billet fill. The total figure for sea tours was a sum of squadron billet fills and afloat staff/ship's company billets.

The final sort separates all the records within each activity by tour number. This last step was done via the "Past Duty Station Counter" field in the OMF. This figure, however, did not include attendance at the Naval Postgraduate School (NPS), War College, or any of the individual Service Colleges as tours, so all the records were screened for attendance at these schools, and those which were positive had the "Past Duty Station Counter" incremented accordingly. Additionally, the data obtained from OP-13 was rank dependent vice tour number dependent and had to be restructured. The method utilized to accomplish this is explained in Section C. 1. of this thesis.

The resultant data file was a two dimensional matrix of numerical data representing the number of TACAIR aviators, referred to as incumbents, at each activity and tour number, as shown in Table 2.3.

TABLE 2.3

DISTRIBUTION OF TACAIR INCUMBENTS

ACTIVITY	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
JPME	0	1	2	14	8	14	11	19	7	1	0
JDA	0	5	3	6	10	24	31	43	42	11	0
SHORE DUTY	47	897	301	265	168	265	237	458	256	48	0
SEA DUTY	1615	464	460	269	347	194	212	230	93	13	0
FRS	0	0	25	35	37	17	9	8	6	0	0

e. Accessions

The accession data is comprised of the number of entries into the community. The model is structured to accept accessions at any tour number of any activity. In this study, recruitment into the TACAIR community was defined as the officer's first sea duty following initial training at a TACAIR FRS. Consequently, the main point for accessions is the SEA DUTY tour 1. A small number of TACAIR FRS graduates spend their first tour at shore duty, and they have therefore been accounted for in SHORE DUTY tour 1. Lateral entries from non-TACAIR communities have not been specifically reflected in the accession data. The decision not to include them was based on three factors. First, the numbers of lateral accessions is very small. Second, the lateral exits from the community is not reflected in the attrition data, and in some degree compensates for lateral accessions. Third, both lateral entry and exit data for the TACAIR community are not readily available and difficult to collate. The specific accession data which was used was obtained by collation of FRS attendee figures from the OMF and through the TACAIR community manager. Manipulation of accessions to reflect changes in recruiting rates, actual or projected, is one of the main tools this model provides to the community manager for projecting community shortages/excesses which may result therefrom.

f. Transition Probability

Every officer finishing a tour transitions to the next tour or is attrited. Some transitions are not possible (have zero probability), some are mandatory (have 100% probability), but most lie somewhere between, with two or more possible alternatives. The probabilities utilized in the modeling of the TACAIR community were generated utilizing a combination of three sources. First, information regarding transition probabilities which were a result of community policy were collected. Second, the probabilities which could be determined by analysis of the "Past Duty Station" fields of the OMF were assembled. Third, all probabilities were reviewed by the community manager with the intention of updating them to current community trends. This resulted in a three dimensional array of numerical data in which the probabilities are arranged in ten (the number of tours minus one) 5 x 5 matrices (5 being the number of activities). Each matrix, therefore, represents the possible transitions from one activity type to another (possibly the same) activity type when an officer finishes the 1st, 2nd,... , or 10th tour.

Specific transition data could not be generated for transition from any activity to FRS. This was because attendance at FRS is only identifiable in the OMF when an officer is currently there. Consequently, in order to generate these transition probabilities, the value of the transition probability for SEA TOUR was gradually decremented and the difference added to the transition probability for FRS until the number of personnel in FRS for each tour after forecasting for four or eight quarters was consistently equal to the incumbents as identified in Table 2.3.

Attrition rates are accounted for indirectly by the fact that the transition probabilities of some rows sum to less than one. Previously, in Johnson's thesis [Ref. 7], attrition data was based on expert opinion. In this thesis, an attempt was made to improve the accuracy of the attrition rates by extrapolating them directly from the data. However, great difficulty was encountered effecting the extrapolation, primarily because of the way the data is maintained. Several assumptions were necessary regarding the distribution of TACAIR officers to equate grade with tour, and Years of Commissioned Service (YOCS) with tour. The requirement to make these assumptions in order to derive the attrition rates is a clear indication of an area in which the FORECASTER model should be improved. If the model could be expanded to accommodate data based on YOCS, the data could be entered directly, thereby avoiding the inaccuracies generated by the use of these assumptions.

The attrition data used herein was obtained directly from the community manager and from the OMF. The data obtained from the OMF were annual totals, covering the second half of 1985, and all of 1986, 1987, and 1988. This was used to validate the data provided by the community manager, which were annual totals and totals by rank for the years 1979 to 1988. A comparison of the attrition totals for the years 1986 to 1988 is provided in Appendix C.

The attrition data generated from the OMF was for the entire aviation community, and was sorted by service entry date, which was then equated to Years of Commissioned Service (YOCS). Next, to compute the TACAIR portion of the attrition, rank specific percentages of TACAIR officers were multiplied against the appropriate year's number of attritions. The determination of which rank specific percentage to use for each year was made by using the percentage for that rank which comprised the largest number of officers with those YOCS. As an example, 20 naval aviation officers attrited in their tenth year of service. Of all TACAIR officers in their tenth year, the overwhelming majority (76%) are Lieutenant Commanders. Consequently, the percentage of Lieutenant Commanders in the aviation community which are TACAIR (53%) was multiplied against the attrition total for that YOCS (20 officers) to obtain the number of TACAIR community officers who attrited in their tenth year of service (10 officers). This provided an estimate of the numbers of TACAIR officers attriting by YOCS. The next step in the process was to distribute these attritions by tour number. The percentage of officers within each YOCS by tour number was computed from data provided in the OMF, and these percentages were then multiplied against the numbers of attrition for the corresponding YOCS and summed over all YOCS to obtain the number of attritions by tour number. Finally, the attritions were distributed by activity. A sort was done on the attrition data to determine the percentages, by rank and by tour number, of officers attriting from sea duty versus shore duty. Since the attrition data did not contain sea/shore information further subdivided into JPME, JDA, or FRS activities, certain assumptions had to be made to distribute the attrition rates. First, it was assumed that there was no attrition from FRS. Since entry into the community has been defined as after an initial FRS tour, all FRS tours contained within the model are those which an officer would attend enroute to a department head or CO/XO tour, or to transition to a different aircraft type than that previously qualified in. Consequently, it is reasonable to assume that an officer would not attrite during or at the completion of an FRS tour. Second, only officers with demonstrated career intentions are detailed to a JPME tour. Those officers do not attrite during JPME, so attrition rates were not applied against them either. Finally, since all JDA tours are shore duty, the same attrition rates that were applied to SHORE DUTY were applied to JDA.

The probabilities developed for this specific analysis and shown in Table 2.4 should in no way be construed as being "hard and fast", nor should their accuracy be viewed as being representative of the overall accuracy of the model itself. User manipulation of these probabilities to reflect current or projected community policies concerning career path structure, and/or increasing or decreasing attrition rates, is the major tool with which the user can accomplish "what if" analyses.

g. Hard Billets

This is a two dimensional matrix which has the number of activities and the number of tours as its dimensions. The numerical data contained in the matrix, shown below in Table 2.5, represent the number of "hard fill" billets in each of the activities by tour number. These are billets which must be filled by aviators from the TACAIR community. This required some manipulation of the data, as billet structure in the U.S. Navy is not by tour number but by rank. Consequently, the previously mentioned assumptions made to equate tour number and rank which are addressed in Section II.D. were also critical to the construction of this data set.

TABLE 2.4

STATE TRANSITION PROBABILITIES

		JPME	JDA	SHORE	SEA	FRS			JPME	JDA	SHORE	SEA	FRS
1	JPME	0	0	0	0	0	6	JPME	0	.59	0	.37	.04
	JDA	0	0	0	0	0		JDA	0	0	.45	.5	.04
	SHORE	0	0	0	1.0	0		SHORE	0	.05	.45	.45	.04
	SEA	0	.01	.83	.13	.03		SEA	.06	.07	.54	.32	0
	FRS	0	0	0	1.0	0		FRS	0	0	0	1.0	0
2	JPME	0	0	0	0	0	7	JPME	0	.59	0	.4	.01
	JDA	0	0	0	0	0		JDA	0	0	.59	.37	.01
	SHORE	0	0	.21	.70	0		SHORE	0	.07	.59	.3	.01
	SEA	.02	.03	.63	.31	0		SEA	.05	.11	.48	.36	0
	FRS	0	0	0	1.0	0		FRS	0	0	0	1.0	0
3	JPME	0	.59	0	.29	.12	8	JPME	0	.59	0	.39	.02
	JDA	0	0	.12	.5	.12		JDA	0	0	.61	.23	.02
	SHORE	0	.01	.12	.49	.12		SHORE	0	.09	.61	.14	.02
	SEA	.04	.01	.6	.28	0		SEA	.04	.16	.48	.29	0
	FRS	0	0	0	1.0	0		FRS	0	0	0	1.0	0
4	JPME	0	.59	0	.28	.13	9	JPME	0	.59	0	.41	0
	JDA	0	0	.13	.67	.13		JDA	0	0	.64	.2	0
	SHORE	0	.02	.13	.65	.13		SHORE	0	.09	.64	.11	0
	SEA	.04	.03	.47	.43	0		SEA	.06	.25	.44	.25	0
	FRS	0	0	0	1.0	0		FRS	0	0	0	0	0
5	JPME	0	.59	0	.29	.12	10	JPME	0	.59	0	.41	0
	JDA	0	0	.26	.61	.12		JDA	0	0	.64	.2	0
	SHORE	0	.08	.26	.53	.12		SHORE	0	.09	.64	.11	0
	SEA	.03	.05	.70	.22	0		SEA	.06	.25	.44	.25	0
	FRS	0	0	0	1.0	0		FRS	0	0	0	0	0

TABLE 2.5

HARD BILLET DATA

ACTIVITY	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
SHORE DUTY	30	1127	352	331	204	302	243	360	162	28	0
SEA DUTY	1747	292	296	146	181	103	110	96	20	6	0
FRS	0	0	25	35	37	17	9	8	6	0	0

h. Soft Billets

This was a two dimensional matrix of the same size as the data for "Hard Billets". The numerical data it contains, shown in part in Table 2.6, represent the number of "soft fill" billets in each of the activities by tour number. These are the TACAIR community's "fair share" of the "1300" designator general aviation billets which can be filled by any naval aviator, the "1000" designator billets which can be filled by any line officer, and the "1050" designator billets, which can be filled by any line officer with a warfare specialty. The currently employed "fair share" percentages vary for each of these categories. NMPC provided the percentages by rank currently being applied by them to compute the aviation communities "fair share" of the "1000" and "1050" billets. These percentages were then multiplied by the percentages by rank of TACAIR officers in the aviation community. The result was a percentage for each rank from Ensign to Captain of "1000", "1050", and "1300" billets which should be filled by officers from the TACAIR community. These percentages were then multiplied against the actual numbers of billets, and, as before, some manipulation of the data to equate tour number and rank was required.

TABLE 2.6

SOFT BILLET DATA

ACTIVITY	TOUR NUMBER										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
JPME	0	1	2	14	8	14	11	19	7	1	0
JDA	0	1	7	26	22	52	54	125	78	15	0
SHORE DUTY	12	134	50	51	40	82	85	202	137	27	1
SEA DUTY	186	69	91	50	67	44	59	73	30	5	0

2. User Interface Functions

The user interface functions provide the user with the capability to modify the data files, run the model, select the desired analysis, select the information to be displayed on-screen and/or printed, and to save the modified data files. Modifications to the data files allow the user to manipulate the structure of the specific community career path being analyzed, and to vary the flow of officers through it. Once the user initiates model execution, the program enters the computational functions and, upon completion of the computation, provides the user with options for selection of the different analyses which the program is capable of performing. Prior to termination of model use, the program offers the user the option of saving the data entered for that session. Each of the user interface functions are described in detail, along with their interfunctional interfaces, in the following paragraphs.

a. FORECASTER (1)

This function is automatically initialized with the loading of the workspace. First, it calls the function PRINTCONTROL to allow the user to turn the printer on to record the program session. Next, it allows the user to select a brief introduction to the model, which is contained in the function INTRODUCTION. Third, it calls FILERETRIEVE, which provides the user with the capability to load any previously stored data set. Then it calls the function BEGIN, which provides the user with the capability to change the content of the data file currently in the workspace. Finally, it calls MENU, which allows the user to select from any of the program options for running, changing, saving or printing data and/or results, as applicable.

b. INTRODUCTION (1.1)

The INTRODUCTION function provides the user with a brief on-screen introductory narrative to the model. It displays a short description of the model and describes the variables which are represented in the data sets. Upon completion, the user is returned to the calling function, FORECASTER.

c. *BEGIN (1.2)*

BEGIN can be called either from FORECASTER or from MENU. It retrieves the activity names, the number of activities, and the number of tours from the data sets ACT, A, and R respectively. The names of activities are displayed, and the function FORMAT is called, which provides the user with the option of accepting the current names. If accepted, the program returns to FORECASTER which then calls MENU. If the user intends to change the current names, the program returns to BEGIN, which then displays the options of deleting, inserting, or changing an activity or, once again, to accept them all. Depending on which option is selected, the program either calls DELETE, INSERT, or CHANGE, or returns to FORECASTER which then calls MENU.

d. *FORMAT (1.2.1)*

The function FORMAT can be called from BEGIN, ALTER, and PROBTRANS. It retrieves the activity names from data set ACT, and uses these in on screen display generation. The function prompts the user to enter the letter "C" if any of the displayed data is to be modified, or to press "ENTER" to accept the data, and returns that input to the calling function.

e. *DELETE (1.2.2)*

DELETE is called from BEGIN when the user's intention to delete an activity has been entered. The function retrieves the activity names from the data file ACT, counts them, and assigns the count to data file A. It then retrieves the length of tours matrix from data file LMATRIX, counts the number of tours, and assigns this value to the data file R. DELETE then calls ACFORM, which generates the on-screen display of numbered activity names, and requests the user enter the number of the activity to be deleted. The function then displays the name of the activity to be deleted and obtains confirmation of the user's intent to delete it. Once confirmed, the function retrieves and modifies the data files LMATRIX, INCUMBENTS, ACT, ACCESS, PMATRICES, HBILL, and SBILL to remove the activity and the data associated with that activity in each of the above files. The program then returns to FORECASTER, which then calls MENU.

f. ACFORM (1.2.2.1)

The function ACFORM can be called from the functions BILL, CHANGE, DELETE, and INSERT. It retrieves the activity names from data file ACT, and generates the on-screen display of activity names. The program then returns to the calling function.

g. INSERT (1.2.3)

INSERT is called from BEGIN when the user's intention to add an activity has been entered. The function retrieves the activity names from the data file ACT, counts them, and assigns the count to data file A. It then retrieves the length of tours matrix from the data file LMATRIX, counts the number of tours, and assigns this value to the data file R. INSERT then calls ACFORM, which generates the on-screen display of numbered activity names, and requests the user enter the number of the activity the new activity is to follow. The function then displays the name of the activity the new activity will follow and obtains confirmation of the users intent to insert the new activity there. Once confirmed, the function requests the new activity's name, then retrieves and modifies the data files A, ACT, LMATRIX, INCUMBENTS, ACCESS, PMATRICES, HBILL, SBILL, and INCUMBENTS to allow for inserting the data file specific activity data . The program then returns to FORECASTER, which then calls MENU.

h. CHANGE (1.2.4)

CHANGE is called from BEGIN when the user's intention to change an activity has been entered. The function retrieves the length of tours matrix from data file LMATRIX, counts the number of activities (rows) and the number of tours (columns), and assigns these values to data files A and R, respectively. CHANGE then calls ACFORM, which generates the on-screen display of numbered activity names, and requests the user enter the numbers of the activities to be changed. The function then retrieves the activity names from ACT, displays the names of those selected to be changed, and obtains confirmation of the users intent to change them. Once confirmed, the function requests the new names and modifies the data file ACT The program then returns to FORECASTER, which then calls MENU.

i. MENU (1.3)

This is the main function in the program. It is called by FORECASTER, and retrieves incumbent and tour length data from the data files INCUMBENTS and LMATRIX. MENU provides the user with the options to review or change data in any of the data sets, initialize model execution, review results from the previous model execution, save modified data sets, print results, and exit the program. To effect data changes, the functions BEGIN, LMATRIX, ACCS, ALTER, PROBTRANS, and BILLETS can be called to change activity, tour length, accession, incumbent, transition probability, and hard and soft billet data, respectively. The function GOCHECK is called when model initialization is selected. Upon completion of model execution, the program returns to MENU, which then calls the functions FORM, ANALYSIS and REPLACE to display the results and provide the user with the option of replacing the current incumbent data with the forecasted distribution. The function provides the option to save the current data set, and effects the saving of data by calling the function SAVEDATA. After the user has either saved data or declined to save data, the program then returns to FORCASTER and terminates.

j. BILLETS (1.3.1)

This function is called from MENU when the user has entered the intention to review and/or modify either the hard or soft billet data, which is contained in the data files HBILL and SBILL. The function retrieves the hard billet data in HBILL and calls ALTER, which provides for on-screen editing of the data, and then rewrites the data file with the modified data. Once complete, the process is repeated for the soft billet data in SBILL. The program then returns to FORECASTER, which then calls MENU.

k. ALTER (1.3.2)

ALTER is called from BILLETS when the user has entered the intention to review or modify the hard or soft billet data, or from MENU when the user has entered the intention to review or modify the tour length, incumbent data, or accession data. The ALTER function call is executed with a concurrent data retrieval from either HBILL, SBILL, LMATRIX, INCUMBENTS, or ACCESS, as applicable. The function FORMAT is called from ALTER, and the data currently resident in the imported data file is displayed with the option of accepting it. If accepted, the program returns to the calling function. If the user intends to change the current values, the program returns to ALTER, which provides for on-screen editing of the data, and then rewrites the data file with the modified data. The program then returns to the calling function.

l. PROBTRANS (1.3.3)

This function is called from MENU when the user has entered the intention to review and/or modify the transition probabilities, which are contained in the data file PMATRICES. The function retrieves the number of tours from data file A to compute the number of transition probability matrices, which is then used in a brief narrative explanation of these matrices. PROBTRANS then requests the user input the matrix number to be reviewed/modified, with which it calls the function FORMAT. The FORMAT function call is executed with a concurrent data retrieval from PMATRICES, and the data currently resident in the imported data file is displayed with the option of accepting it. If accepted, the program returns to the calling function. If the user intends to change the current values, the program returns to PROBTRANS, which provides for on-screen editing of the data, and then rewrites the data file with the modified data. The program then calls the function FORMAT with the modified data for a final matrix display prior to exiting the function, and allows the user to remain in the function to modify additional matrices. Upon user instruction, the program returns to the calling function.

m. ACCS (1.3.4)

ACCS is called from MENU when the user has entered the intention to review or modify the accession data. It retrieves the accession data from the data file ACCESS, and replaces it with data entered by the user. The program then calls the function FORMAT with the modified data for a final display prior to exiting the function, and allows the user to remain in the function to modify additional data. Upon user instruction, the program returns to the calling function.

n. SAVEDATA (1.3.5)

SAVEDATA can be called by MENU under two circumstances. First, when a user selects to save the data set currently in the workspace, or, second, to save the current data after exiting from the model. It allows the user either to save the data into a new file, for which the user must enter a name, or to rewrite the existing data file. If the user elects to save the data in a new file, the user enters the new file name. SAVEDATA then calls DROPBLANK to remove any trailing blanks in the name, then FNAMECHECK to ensure that the file name is valid and does not already exist. The data file is then written or re-written, as appropriate, and program control is returned to MENU.

o. FNAMECHECK (1.3.5.1)

This function is called from SAVEDATA. It checks that the user entered intended data file name is an acceptable file name in APL. If the file name is valid, the function then calls DUPLFNAMECHECK to verify that the file name is not already in use. If the file name is not valid or already exists, the user is instructed to enter a new file name, and the checking procedure is repeated. Program control is returned to SAVEDATA.

p. DUPLFNAMECHECK (1.3.5.1.1)

DUPLFNAMECHECK is called from FNAMECHECK. It checks if the user entered file name is already in use, and, if so, displays an error message advising the user to enter a new file name. If the user enters a new file name, the function calls DROPBLANK to remove any trailing blanks, then program control is returned to FNAMECHECK.

q. DROPBLANK (1.3.5.2)

DROPBLANK can be called from SAVEDATA, FNAMECHECK, or DUPLFNAMECHECK. It deletes any trailing blanks at the end of a user generated file name, then returns control to the calling function.

r. GOCHECK (1.3.6)

The GOCHECK function is called from MENU when the user enters the selection to run the model. Its primary purpose is to conduct data inconsistency checks prior to the actual running of the model by checking accessions and incumbents for corresponding tour lengths and transition probabilities, and for duty assignments of zero length to which some personnel flow is directed. It retrieves accession, tour length, transition probability and incumbent data from the ACCESS, LMATRIX, PMATRICES, and INCUMBENTS data files. For each check the user is provided the option of returning to the MENU function to modify the data, or to continue. Upon completion of all checks this function calls START.

s. START (1.3.6.1)

START is called by GOCHECK, and is the last of the user interface functions prior to the program entering the computational functions. The function requests the user input the number of periods to be forecast, following which it initiates the model execution by calling PERSONNEL. Upon completion of the computations the program returns to START, which then calls FORM to display the results. Options for further analyses are provided which, if requested, will cause START to call ANALYSIS. Finally, the user is provided the option of saving the forecasted distribution as the new incumbent data, after which the program returns to MENU.

t. FORM (1.3.7)

This function is called by MENU when a user selects to review a previous output or analysis, and by START for the display of the results of a just completed model run. It retrieves the activity names from ACT and generates the on-screen display of the model run result. Program control is then returned to the calling function.

u. ANALYSIS (1.3.8)

This function is called immediately following FORM by MENU when a user selects to review a previous output or analysis, and by START for the display of the results of a just completed model run. It retrieves the activity names, number of activities, hard billet and soft billet data from ACT, A, HBILL, and SBILL. Using this data and the results of the model run it generates displays of personnel per activity and total personnel in the system. The function then calls BILL for an analysis of billet data. Program control is then returned to the calling function.

v. BILL (1.3.8.1)

BILL is called either once or twice by ANALYSIS, depending on user input. The first call is with hard billet data, the second, which is user input dependent, is with a sum of both hard and soft billet data. BILL retrieves the number of activities and the number of tours from data files A and R, and uses these along with the billet data to generate on-screen displays of forecasted billet fill numbers and percentages. Program control is then returned to the calling function.

w. REPLACE (1.3.9)

This function is called by MENU when a user selects to review a previous output or analysis, and by START following the display of the results of a just completed model run. It provides the user with the capability to replace the current data in the INCUMBENT data file with the forecasted distribution from a just completed model run. Program control is then returned to the calling function.

x. FILERETRIEVE (1.4)

This function is called from FORECASTER to retrieve and display a list of APL data files available on the current drive, and to load the user designated file into the workspace. Program control returns to FORECASTER.

y. PRINTCONTROL (1.5)

PRINTCONTROL can be called either from MENU or from FORECASTER. It calls the functions PRINTER, ON and OFF to allow the user to turn the printer on or off to record the program session at the start of the session, or at any time during the session if the menu is actively displayed. Program control is returned to the calling function.

z. ON (1.5.1) and OFF (1.5.2)

These two functions are called from PRINTCONTROL as arguments with the function PRINTER to change the printer on or off bit, as appropriate. Control returns to PRINTCONTROL.

aa. PRINTER (1.5.3)

This function contains the APL commands for turning the printer on or off from inside an active workspace. It is called from PRINTCONTROL and returns control there when finished executing.

bb.EPSON960DOTAPL (1.5.4)

This function is called from PRINTCONTROL, and provides the character set for APL characters to the printer. Control returns to PRINTCONTROL.

3. Computational Functions

a. PERSONNEL (1.3.5.1.1)

PERSONNEL is called by START after the user enters the number of periods to be forecasted. It calls PREPDATA to format tour length, transition probability, incumbent, and accession data, then calls RAVEL with the retrieved tour length data from LMATRIX. Program control is then returned to START.

b. PREPDATA (1.3.5.1.1.1)

This function is called by PERSONNEL to format the data for the computation. It retrieves tour length, transition probability, incumbent, and accession data from LMATRIX, PMATRICES, INCUMBENTS and ACCESS, respectively. It unravels and indexes the tour length data, and calls PARSUM to compute the sums of tour lengths for each tour number. The program then calls BUILD with transition probability data, UNRAV with incumbent data, and UNRAV0 with accession data, after which control returns to PERSONNEL.

c. RAVEL (1.3.5.1.1.2)

RAVEL is called from PERSONNEL to construct a matrix with the "unraveled" incumbent data, and in the process sums incumbents at different levels of experience within each activity-tour combination. Program control is then returned to PERSONNEL.

d. PARSUM (1.3.5.1.1.1.1)

The function PARSUM can be called from either PREPDATA or BUILD. It computes the sum of tour lengths for each tour number for PREPDATA, or the number of feasible tours for each tour number for BUILD. Program control is then returned to the calling function.

e. BUILD (1.3.5.1.1.1.2)

BUILD is called from PREPDATA to construct a single large matrix from the transition probability matrices. The function ensures that transfers are made only from and to feasible activity-tour combinations by eliminating rows and columns to which the probability of transitioning is zero. To define the size of the resultant matrix, BUILD calls

PARSUM to compute the number of feasible tours for each tour number. Program control is then returned to PREPDATA.

f. UNRAV (1.3.5.1.1.1.3)

UNRAV is called by PREPDATA. It takes the incumbents matrix and divides it by the tour length matrix, resulting in a matrix of ratios which is then converted to a vector with the infeasible billets omitted. Additionally, each element of the matrix is repeated as many times as its corresponding length value. The result is a vector of as many components as the total sum of all tour lengths. During the computations, the functions ROUND and DIV are called. Program control is then returned to PREPDATA.

g. UNRAV0 (1.3.5.1.1.1.4)

UNRAV0 is called by PREPDATA. It unravels the accessions matrix by columns, omitting those values where the corresponding tour length value is zero. Then a vector representing feasible billets is formed where each billet is represented by a number of components equal to its length. Accessions are then placed in the first experience level of each feasible billet. Program control is then returned to PREPDATA.

h. ROUND (1.3.5.1.1.1.3.1)

ROUND is called by UNRAV to limit the number of significant digits utilized in the computations in UNRAV. Program control is returned to UNRAV.

i. DIV (1.3.5.1.1.1.3.2)

DIV is called by UNRAV to divide the incumbents matrix by the tour length matrix. Program control is returned to UNRAV.

C. ASSUMPTIONS REQUIRED TO EFFECT THE MODEL

1. Rank/Tour Equivalence Estimation

A critical assumption to be made in order to utilize the model was to equate tour numbers with rank. This was necessary because each rank itself can contain multiple tours and/or a promotion may occur during a tour. As an example, a typical Lieutenant

Commander in the TACAIR community will spend approximately 6 years in grade, and usually execute three tours of duty - two sea tours and a shore tour. This makes it nearly impossible to provide an accurate probability of what his next tour will be if given only the information that he is a Lieutenant Commander in a sea tour. It was, therefore, necessary to utilize tour numbers to achieve the ability to forecast, particularly with regard to manpower shortages/excesses in specific billet categories. Unfortunately, most agencies within the Navy, including OP-13, do not maintain officer data based on tour numbers. Rather, data is usually maintained by rank, e.g. attrition data and billet data, while officer personnel data are maintained by Years of Commissioned Service (YOCS). However, it is possible to construct data by activity and tour number from the OMF, and convert data based on rank to being tour number dependent by developing a table of rank/tour number equivalences. The data displayed in Table 2.7 shows the numbers of TACAIR officers by rank and tour number.

By computing the relative percentages of officers by rank, those percentages can be applied to the numbers of billets in those ranks to determine the numbers of billets by tour number. The percentages shown in Table 2.8 were utilized in computing billet distribution by tour number for the hard and soft billets, Paragraphs B.2.g and B.2.h.

2. Tour Definition

Consideration must be given to determining what qualifies as a tour. Attempting to include all possible tours, regardless of tour length or the overall percentage of personnel serving in such tours, would be excessively laborious and of limited value to the user. Consequently, all possible tours must be reviewed with the intention of identifying those critical to successful modeling of the specific community. The primary criterion utilized in determining which tours to include in the model was the length of a tour. Any tour designed to be 12 months in duration or greater was identified and categorized as discussed previously in Paragraph B.2 a. Tours of less than 12 months were reviewed by function.

TABLE 2.7

RANK/TOUR NUMBER COMPARISON

NUMBER OF TOURS	RANK 01	02	03	04	05	06
1	490	1005	766			
2		69	1282			
3			579	184		
4			109	437		
5				480	41	
6				302	191	
1				138	343	
8				62	500	188
6					139	256
10						62
11						1

NOTE: Figures of 15 or less have been deleted for clarity, with the exception of tour number 11.

Those tours which were for training, and were always followed by a specific tour which utilized that training, were combined with the follow-up tour and the tour length of the follow-up tour was increased by the length of the training. Assignments to various colleges as a student range from six months to three years. Educational tours involving JPME were, of course, classified as tours, while all other educational tours of less than 12 months were disregarded. Attendance at the Naval Postgraduate School, or other graduate institution, which is normally in excess of 12 months, was counted as a tour and included in the Shore Tour totals.

TABLE 2.8

RANK/TOUR NUMBER PERCENTAGES

NUMBER OF TOURS	RANK 01	02	03	04	05	06
1	100	94	28			
2		6	47			
3			21	11		
4			4	27		
5				30	3	
6				19	16	
7				9	28	
8				4	41	37
9				19	16	[illegible]
10						12
11						1

3. 1000, 1050 and 1300 Billet Distribution

There are billets which specifically require TACAIR officers, "1300" designator billets which require any aviation officer, "1000" designator billets which require any unrestricted line officer, and "1050" designator billets which require an officer with a warfare specialty (e.g. surface, aviation, or submarine officers). In order to determine the TACAIR community's fair share of these non-TACAIR community specific billets, a proportion of the billets was assigned which was equivalent to the proportion, rank by rank, that the TACAIR sub-community represents. As an example, there were 169 Lieutenant Commander Joint Duty billets assigned to the aviation community, none of which were TACAIR specific. Since TACAIR Lieutenant Commanders comprise 53% of the total number of aviation Lieutenant Commanders, 53% of the 169 billets (90 billets) were assigned to the TACAIR community. The assumption which was made to allow this computation was that the proportion of Lieutenant Commanders in the TACAIR community available for shore duty was equal to the proportion of Lieutenant Commanders in the aviation community as a whole.

III. ANALYSIS OF MODEL RESULTS

A. INITIALIZATION

The model was initially run utilizing the data as specified in Chapter 2 of this Thesis without modification in order to verify the data. The model ran well, with the one discrepancy that previously computed attrition rates applied to the eighth, ninth, and tenth tours were found to be insufficient to maintain the community size at the approximately constant historical level, and were therefore increased. The difference can be attributed to the broad nature of the assumptions required in transforming the data from general aviation to TACAIR specific, and from rank and YOCS dependent to tour dependent. The higher attrition rates were applied, and the resultant data file containing the updated transition probabilities was then utilized as the basis for the analyses.

B. ANALYSES

1. Introduction

Prior to presenting a discussion of projected billet shortfalls, it should be noted that for all but the fifth tour billets, and for the community overall, there were more billets identified to be filled than there were incumbents. For the community as a whole, there were approximately nine percent more billets than incumbents.

2. Joint Duty

In order to assess the effect of Title IV of the Goldwater-Nichols Act on the TACAIR community, the current requirements were established, and current and projected trends were identified and evaluated. The current Joint Duty billet requirements for the aviation community, by rank, were provided by the TACAIR community manager in OP-130. These billets were then redistributed by the percentages of TACAIR officers in each rank within the aviation community, and converted from rank dependent to tour number dependent. These are the "Required" figures shown in Table 3.1. The numbers of officers in attendance at the educational institutions granting Joint Professional Military Education (JPME) credit, and the transition probabilities to attend JPME, were generated from empirical data drawn from the OMF. Additionally, 59 percent of all JPME graduates transitioned to a JDA for their next tour, which was based on the FY-88 figures reported to Congress [Ref. 10]. The FORECASTER program was used to generate four and eight quarter forecasts based on current transition probabilities, the results of which could then be used to identify problem areas. These results, compared with TACAIR's required billets, are also shown in Table 3.1. The model results indicate that, even after eight quarters, the current rotation rates would result in a deficiency in the numbers of officers in the fourth, sixth, seventh, and eighth tours in JDA billets, while there is a projected excess in tours nine through eleven. The total number of JDA billets which TACAIR is required to fill is 385, and, with the current rate of rotation in and out of those billets, at the end of eight quarters 381 will be filled. However, there is a mal-distribution of officers with regard to these billets, resulting in a shortage of officers required to fill the low- and mid-grade billets, and an excess of officers available to fill the higher grade billets.

TABLE 3.1

COMPARISON OF JOINT DUTY BILLET FILLS

NUMBER OF QUARTERS FORECAST	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
Required	0	1	7	26	24	52	57	125	78	15	0
4	0	9	5	9	20	31	37	49	72	45	8
8	0	11	9	11	27	35	36	52	95	81	24

In order to develop a rotation policy which would alleviate this inequity, the transition probabilities were adjusted through a series of trial and error manipulations.

Several factors must be considered when changing the transition probabilities. Community policies, e.g. maintaining sea/shore rotation, should not be arbitrarily violated. In this regard, increasing the probability of transitioning from SHORE DUTY to JDA or JPME was avoided whenever possible. Probabilities for transitioning from any activity (primarily SHORE DUTY) to FRS had been generated by adjusting them until they resulted in the required number of officers in SEA DUTY, thereby modeling the flow of aviators through FRS to a squadron. Consequently, these transition probabilities to FRS were not adjusted to increase or decrease flow through JDA and JPME billets. These considerations resulted instead in increasing the probabilities of transitioning from SEA DUTY to JDA or JPME as the primary means of effecting billet fills in JPME and JDA, and decreasing the probability of transitioning from SEA DUTY to any other SHORE DUTY billet. Finally, great care must be taken to understand the impact of making such adjustments. The probabilities governing the flow of personnel through these billets must be constructed in such a way as to ensure sufficient numbers of officers are receiving JPME, as there is the minimum requirement established in the Joint Chiefs of Staff policy implementing the Goldwater-Nichols Act [Ref. 2]. Table 3.2 presents a comparison of the transition probabilities from SEA and SHORE activities, from each of the tours one through ten, before and after these changes were made.

The model was run with the new transition probabilities forecasting for eight quarters, which resulted in fulfilling 100% of the previously delineated requirements of TACAIR's "fair share" billet obligations by the end of the eighth quarter, and the required (fifty) percent of JPME graduates serving at JDAs immediately following JPME. The major changes in rotation and assignment embodied by these probabilities can be summarized as follows:

- No assignments to JDA or JPME after the eighth tour, and decrease in eighth tour assignments by five percent.
- Increase the proportion of JPME attendees compared to direct (e.g. SEA DUTY to JDA) JDA assignments.

- Increase the percentages of officers detailed to JPME in the third through seventh tours. The most significant of these increases were in fifth, sixth and seventh tour officers transitioning from SEA DUTY to JPME, with 22, 14, and 22 percent increases, respectively. These changes are primarily at the expense of transfers from SEA DUTY to SHORE DUTY.

TABLE 3.2

OLD AND NEW JDA/JPME TRANSITION PROBABILITIES

TOUR	ACTIVITY FROM	TO JPME	TO JDA	TO SHORE	TO SEA	TO FRS
1	SEA	0	.01	.70	.24	0
		.01	0	.70	.24	0
2	SEA	.02	.03	.60	.20	.11
		.03	.02	.60	.20	.11
3	SEA	.04	.01	.52	0	.39
		.07	.04	.46	0	.39
4	SEA	.04	.03	.47	.01	.40
		.14	0	.40	.01	.40
5	SEA	.03	.05	.77	.01	.12
		.25	.08	.52	.01	.12
6	SEA	.06	.07	.62	.10	.12
		.20	.10	.45	.10	.12
7	SHORE	0	.07	.53	.09	.18
		.04	.23	.33	.09	.18
	SEA	.05	.11	.47	.35	0
		.27	.21	.15	.34	0

TOUR	ACTIVITY FROM	TO JPME	TO JDA	TO SHORE	TO SEA	TO FRS
8	SHORE	0	.05	.48	.13	.06
		0	.07	.46	.13	.06
	SEA	.04	.16	.48	.21	.08
		.10	.02	.56	.21	.08
9	SHORE	0	.08	.56	.10	0
		0	0	.64	.10	0
	SEA	.06	.25	.42	.24	0
		0	0	.73	.24	0
10	SHORE	0	.08	.56	.10	0
		0	0	.64	.10	0
	SEA	.06	.25	.41	.25	0
		0	0	.72	.25	0

Note: Percentages are shown here with the original numbers directly over the changed numbers.

A restatement of these changes in more general terms and relating them to grade and seniority vice tour numbers is:

- Significantly decrease the number of senior-grade Commanders and mid- and senior-grade Captains being assigned to JPME or JDA.

- Increase the numbers of senior-grade Lieutenants, all Lieutenant Commanders, and junior-grade Commanders assigned to JPME or JDA.

These proposed changes are presented here without in-depth discussion on how they will effect the community's ability to fill billets associated with other activities. This discussion will be presented in Paragraph C. of this chapter in a summary of all proposed changes and their effects.

3. Hard Billets

The re-alignment of the transition probabilities to ensure adequate assignment of officer personnel to JDA and JPME billets resulted in four tours (namely, tours three, five, six, and seven) out of which the transition probabilities from SHORE DUTY to SEA DUTY had to be decremented. The probabilities of transitioning from SHORE DUTY to SEA DUTY before and after the change are shown in Table 3.3. For clarity of discussion, the probabilities of transfer to SEA DUTY and FRS have been combined.

TABLE 3.3

SHORE TO SEA TRANSITION PROBABILITIES

SHORE TO SEA TRANSITION	TOUR NUMBER									
	1	2	3	4	5	6	7	8	9	10
OLD	.95	.66	.65	.76	.59	.44	.27	.19	.10	.10
NEW	.95	.66	.42	.76	.21	.41	.18	.19	.10	.10

In order to assess the impact of these changes on the ability of the TACAIR community to fill its hard SEA DUTY billets, the model was used to forecast eight quarters into the future. The results were that, with the exception of the first tour, all hard SEA DUTY billets were projected to be filled (see Table 3.4). Additionally, there was sufficient excess in second SEA tour officers to compensate for first SEA tour shortages.

The problem area which developed was, predictably, SHORE DUTY billets. Shortages were identified in the second and fourth through eighth tours, the most significant of which was the eighth. Analysis of the forecast totals revealed excesses in SEA DUTY billets of sufficient magnitude to compensate for the shortages in most tours. Consequently, the next step was to adjust the transition probabilities to rotate more officers into SHORE DUTY in those tours with identified shortages. This was accomplished by

TABLE 3.4

EIGHT QUARTER FORECAST OF EXCESSES/SHORTFALLS IN HARD SEA AND SHORE BILLETS

BILLET TYPE	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
HARD SHORE	18	-180	58	-92	-106	-92	-58	-184	125	86	47
HARD SEA	-191	169	76	144	202	234	113	112	79	28	10

increasing the transition probabilities to SHORE DUTY by the amount which the transition probabilities to SEA DUTY could be decreased, without resulting in a shortage of officers in SEA DUTY billets, but not more than what was required to satisfy filling the SHORE DUTY billets. Additionally, in an effort to maintain sea/shore rotation, care was taken to ensure that the increases in transition probabilities to SHORE DUTY were applied whenever possible to transitions from SEA DUTY. The resulting new transition probabilities, compared with the set from which they were derived, are shown in Table 3.5.

This resulted in achieving a 99 percent or better billet fill rate for hard SHORE DUTY billets in all but the fifth, seventh and eighth tour billets as shown in Table 3.6. These shortages can be covered by officers in their fourth, sixth and ninth SEA and SHORE DUTY tours, but only at the expense of disrupting the officer's career path. It should be noted that adjusting the transition probabilities on a tour by tour basis does not take into consideration the possibilities of filling billets with the excess officers in adjacent tours. Consequently, the previously noted possibility of relieving the shortage of hard first tour SEA DUTY officers with the excess second tour SEA DUTY officers is no longer possible.

TABLE 3.5

TRANSITION PROBABILITIES FOR INCREASED TRANSITIONS TO SHORE DUTY

TOUR	FROM	TO: JPME	JDA	SHORE	SEA	FRS
1	SEA	.01	0	.70	.24	0
		.01	0	.86	.08	0
2	SHORE	0	0	.17	.43	.23
		0	0	.08	.52	.23
	SEA	.03	.02	.60	.20	.11
		.03	.02	.77	.03	.11
4	SHORE	.02	0	.13	.01	.63
		.02	0	.35	.01	.41
	SEA	.07	.04	.45	0	.39
		.07	.04	.83	0	.01
4	SHORE	.02	0	.10	.01	.75
		.02	0	.06	0	.80
	SEA	.14	0	.40	.01	.40
		.14	0	.51	0	.30
5	JPME	0	.59	0	.10	.31
		0	.59	.41	0	0
	JDA	0	0	.26	.01	.72
		0	0	.78	.01	.20
	SHORE	0	.08	.24	.01	.58
		0	.08	.62	.01	.20
	SEA	.25	.08	.52	.01	.12
		.25	.08	.63	0	.02
6	SHORE	.05	0	.40	.18	.26
		.05	0	.43	.15	.26
	SEA	.20	.10	.45	.10	.12
		.20	.10	.55	0	.12
7	SHORE	.04	.23	.33	.09	.18
		.04	.23	.42	0	.18
	SEA	.27	.21	.15	.34	0
		.27	.21	.49	0	0
8	SHORE	0	.07	.46	.13	.06
		0	.07	.42	.17	.06
	SEA	.10	.02	.56	.21	.08
		.10	.02	.77	0	.08

Note: Percentages are shown here with the original numbers directly over the changed numbers. The percentages for tours nine and ten were unchanged.

TABLE 3.6

REVISED EIGHT QUARTER FORECAST OF EXCESSES/SHORTFALLS IN HARD SEA AND SHORE BILLETS

BILLET TYPE	TOUR NUMBER: 1	2	3	4	5	6	7	8	9	10	11
HARD SHORE	18	-7	46	124	-97	-3	-35	-132	151	81	47
HARD SEA	-191	-4	88	144	3	225	-1	17	68	27	10

4. Soft Billets

These are all the billets assigned on a percentage basis to the TACAIR community. None of them require specific TACAIR aviation experience, although a portion of them are specifically for aviators. One of the uses of the FORECASTER program is to generate statistical support of arguments for increasing or decreasing the numbers of these billets which the community is being required to fill. As with the hard billets, the SEA DUTY billets were given priority over the SHORE DUTY billets. The FORECASTER model does not provide information specific to soft billets, but rather provides the information as numbers and percentages of the combined hard and soft billet data, called TOTAL BILLETS.

With the transition probabilities as developed in this analysis, forecasted community shortfalls as shown in percentages in Table 3.7 were identified in fifth through eighth tour SHORE DUTY billets, and fifth, seventh and eighth tour SEA DUTY billets. Using the seventh tour SEA DUTY billets as an example, only 64 percent of those billets can be filled. This equates to 108 of the 169 total SEA DUTY billets required in the seventh tour. 110 billets are hard, while 59 are soft. Consequently, it can be clearly identified that the community is unable to support assigning seventh tour officers to soft SEA DUTY billets. This argument can be expanded and generalized by analyzing the proportions of officers by rank in their seventh tour. Of approximately 500 officers in their seventh tour, 343 are mid-grade Commanders. Additionally, Commanders make up two thirds of all officers in their eighth tour, where the most severe shortages in billet fills were identified. It could therefore be argued that the numbers of soft billets to be filled by TACAIR Commanders should be reduced. The high percentages of billet fills for tour eleven are the result of the small number of eleventh tour billets available (only one SHORE DUTY billet).

TABLE 3.7

FORECAST PERCENTAGES OF FILL OF TOTAL BILLETS

BILLET TYPE	TOUR NUMBER										
	1	2	3	4	5	6	7	8	9	10	11
TOTAL SHORE	114	89	99	119	44	78	63	41	105	198	4700
TOTAL SEA	80	80	99	148	74	223	64	67	176	540	1000

C. SUMMARY

The underlying reasons upon which the sequence of adjustments made to the transition probabilities were based are important and are therefore reviewed. The original transition probabilities themselves were historical in nature, having been extrapolated from data provided in the Officers Master File for fiscal year 1988. The billet data, however, is current. After the initial data sets were constructed, the model was executed to determine if it was a reasonably accurate reflection of the current system. Any significant deviation, in this case attrition, was then adjusted to better align the model with the reality. Second, since the purpose of this study is to determine the effects of the Goldwater-Nichols Act on the TACAIR community, the probabilities were adjusted to produce 100 percent fill rates of JDA, and associated JPME, billets. In order not to disturb the current sea/shore rotation rates, the increases required to fill these JDA and JPME billets were achieved by increasing the percentage of officers to be transferred from SEA DUTY to JDA and JPME billets at the expense of other SHORE DUTY billets. The third step was to adjust the probabilities of transition primarily from SHORE DUTY and JDA to SEA DUTY to ensure, where possible, 100 percent billet fill rates of hard SEA DUTY billets. Similarly, the probabilities of transition were adjusted, by priority, to fill hard SHORE DUTY, soft SEA DUTY and soft SHORE DUTY billets, in that order. The reasoning employed here was that hard billets are of higher priority to fill than soft billets, and that SEA DUTY is of higher priority than SHORE DUTY. The end result, in addition to the changes in billet fill rates already discussed in the preceding paragraphs, is a change in career path structures. This change is manifested in the newly developed transition probability matrices, represented in Table 3.8.

TABLE 3.8

TRANSITION PROBABILITY MATRIX

		JPME	JDA	SHORE	SEA	FRS			JPME	JDA	SHORE	SEA	FRS
	JPME	0	0	0	0	0		JPME	0	.59	0	.15	.26
	JDA	0	0	0	0	0		JDA	0	0	.45	.3	.24
1	SHORE	0	0	0	.95	0	6	SHORE	.05	0	.43	.15	.26
	SEA	.01	0	.87	.08	0		SEA	.2	.1	.55	0	.12
	FRS	0	0	0	1	0		FRS	0	0	0	1	0
	JPME	0	0	0	0	0		JPME	0	.59	0	.1	.31
	JDA	0	0	0	0	0		JDA	0	0	.59	.1	.28
2	SHORE	0	0	.08	.52	.23	7	SHORE	.04	.23	.42	0	.18
	SEA	.03	.02	.77	.03	.11		SEA	.27	.21	.5	0	0
	FRS	0	0	0	1	0		FRS	0	0	0	1	0
	JPME	0	.59	0	0	.41		JPME	0	.59	0	.39	.02
	JDA	0	0	.12	0	.62		JDA	0	0	.4	.18	.03
3	SHORE	.02	0	.35	.01	.41	8	SHORE	0	.07	.26	.17	.06
	SEA	.07	.04	.83	0	.01		SEA	.1	.02	.77	0	.08
	FRS	0	0	0	1	0		FRS	0	0	0	1	0
	JPME	0	.59	0	0	.41		JPME	0	.59	0	.41	0
	JDA	0	0	.16	0	.77		JDA	0	0	.24	.01	0
4	SHORE	.02	0	.06	0	.8	9	SHORE	0	0	.14	.1	0
	SEA	.14	0	.51	0	.3		SEA	0	0	.35	.1	0
	FRS	0	0	0	1	0		FRS	0	0	0	0	0
	JPME	0	.59	.41	0	0		JPME	0	.59	0	.41	0
	JDA	0	0	.78	.01	.2		JDA	0	0	.64	.2	0
5	SHORE	0	.08	.62	.01	.2	10	SHORE	0	0	.25	.1	0
	SEA	.25	.08	.63	0	.02		SEA	0	0	.74	.25	0
	FRS	0	0	0	1	0		FRS	0	0	0	0	0

In order to identify the changes to the career path structure, these updated matrices must be carefully compared with the original matrices presented in Table 2.4. There are several major changes readily apparent. These changes have been summarized in Table 3.9.

TABLE 3.9

EFFECTS OF MODIFICATIONS ON CAREER PATH STRUCTURE

FROM	TO	SPECIFIC EFFECT	GENERAL EFFECT
3	4	INCREASE SEA TO SHORE 23% INCREASE SHORE TO SHORE 23% DECREASE SEA TO SEA 27% DECREASE SHORE TO SEA 19%	An overall increase of 20% in officers being detailed to shore duty, increasing the number of back-to-back shore tours.
5	6	INCREASE JPME TO SHORE 41% INCREASE JDA TO SHORE 52% INCREASE SHORE TO SHORE 36% INCREASE SEA TO JPME 22% DECREASE JPME TO SEA 41% DECREASE JDA TO SEA 52% DECREASE SEA TO SEA 22% DECREASE SHORE TO SEA 44%	An overall increase of 40% in officers being detailed to shore duty, increasing the number of back-to-back shore tours. Increase the rate of assigning officers leaving SEA DUTY and going to JPME to one out of four.
6	7	INCREASE SEA TO JPME 14% DECREASE SEA TO SEA 20%	20% less back-to-back SEA DUTY, and a small increase of officers detailed to JPME from SEA DUTY.
7	8	INCREASE SHORE TO JDA 16% INCREASE SEA TO JDA 11% INCREASE SEA TO JPME 22% DECREASE SHORE TO SHORE 17% DECREASE SHORE TO SEA 30% DECREASE SEA TO SEA 36%	No back-to-back SEA DUTY. Almost 50% of officers from SEA DUTY detailed to JPME or JDA, 25% from SHORE DUTY to JDA. Only 18% from SHORE DUTY to SEA DUTY.
8 9 10	9 10 11	THE FIGURES FOR THESE TOURS WERE ADJUSTED FOR INCREASED ATTRITION RATES. ALL TRANSITIONS TO JDA AND JPME WERE REMOVED.	No officers detailed to JDA or JPME.

Using the FORECASTER model results as presented here, two areas have been identified where the requirements dictated by the Goldwater-Nichols Act will have serious deleterious effects, depending on how the community manager acts to fulfill those requirements. These areas are billet fill rates and career path structure. Projected shortfalls will occur in officers in their fifth, seventh and eighth tours, which equates primarily to mid- to upper-grade Lieutenant Commanders and low- to mid-grade Commanders. Detailers will be forced to rotate an increased number of third and fifth tour officers, primarily senior Lieutenants and mid-grade Lieutenant Commanders respectively, through back-to-back shore duty tours, which will have a severe negative impact on their operational experience.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

In order to conduct a computer assisted analysis of the effects of the Goldwater-Nichols Act on the Tactical Aviation community, the following needs were identified:

- model the career path structure of the community, including rotation into and out of Joint Duty Assignments (JDA) and Joint Professional Military Education (JPME)
- allow "what if" type structure modifications to determine the effects on the community and on career path structures from increasing or decreasing specific rotation rates
- forecast the effects of career path structure changes on the ability to fulfill manning level requirements.

The FORECASTER model was used to fulfill these needs. The career path structure was modeled through the use of user defined activities in which the officers participate, a matrix of duty assignment durations which considers both the duty assignment type and the seniority of the officer, and a set of transition probability matrices which govern the flow of officers from one duty assignment to the next. Manning level requirements are entered into the model in the form of "hard" and "soft" billets, and the model provides the capability to display an analysis of the level at which these billets will be filled at the end of a user defined forecast period. Career path structure modifications can be simulated either by manipulation of the transition probabilities, or through alteration of the duty assignment durations.

For this specific analysis, the TACAIR community was defined, data concerning the community was collated and restructured as required for use by the model, and the transition probabilities were manipulated to assess the effects of meeting the requirements of the Goldwater-Nichols Act.

The model itself was evaluated, documented and improved during the course of the analysis. As functionality shortcomings were identified they were either documented for rectification in later model versions, or, time permitting, improvements were made during the model evaluation phase and prior to the final analysis. The model documentation provided in Appendices A and B document the version of the model available at the completion of the analysis.

B. CONCLUSIONS

The negative effects of completely fulfilling the requirements established by the Goldwater-Nichols Act and identified in this analysis were twofold. First, a major increase in back-to-back shore duty tours for senior Lieutenants and mid-grade Lieutenant Commanders would be required. This is contrary to community sea/shore rotation policy and would result in an overall decrease in the operational experience and expertise of these officers, which is in violation of the direction to avoid "significant deterioration of warfighting skills or personnel shortages in operational fields." [Ref. 2] Second, the community would experience an inability to fill the currently assigned "fair share" of soft billets which require senior Lieutenants and mid-grade Lieutenant Commanders. In this regard, it is worthwhile to mention here that while the primary focus of this analysis has been to examine the effects of the Goldwater-Nichols Act on the TACAIR community, a significant additional and parallel analysis emerged. This was the model's capability to determine a community's ability to fill the currently assigned "fair share" of soft billets. Using current community data, a community manager can identify points in the community career path model where the community is unable to support the assigned soft billets, and utilize the analysis generated by the model as the basis for arguments to shift some of the billets to other sub-communities within aviation, or to other URL communities.

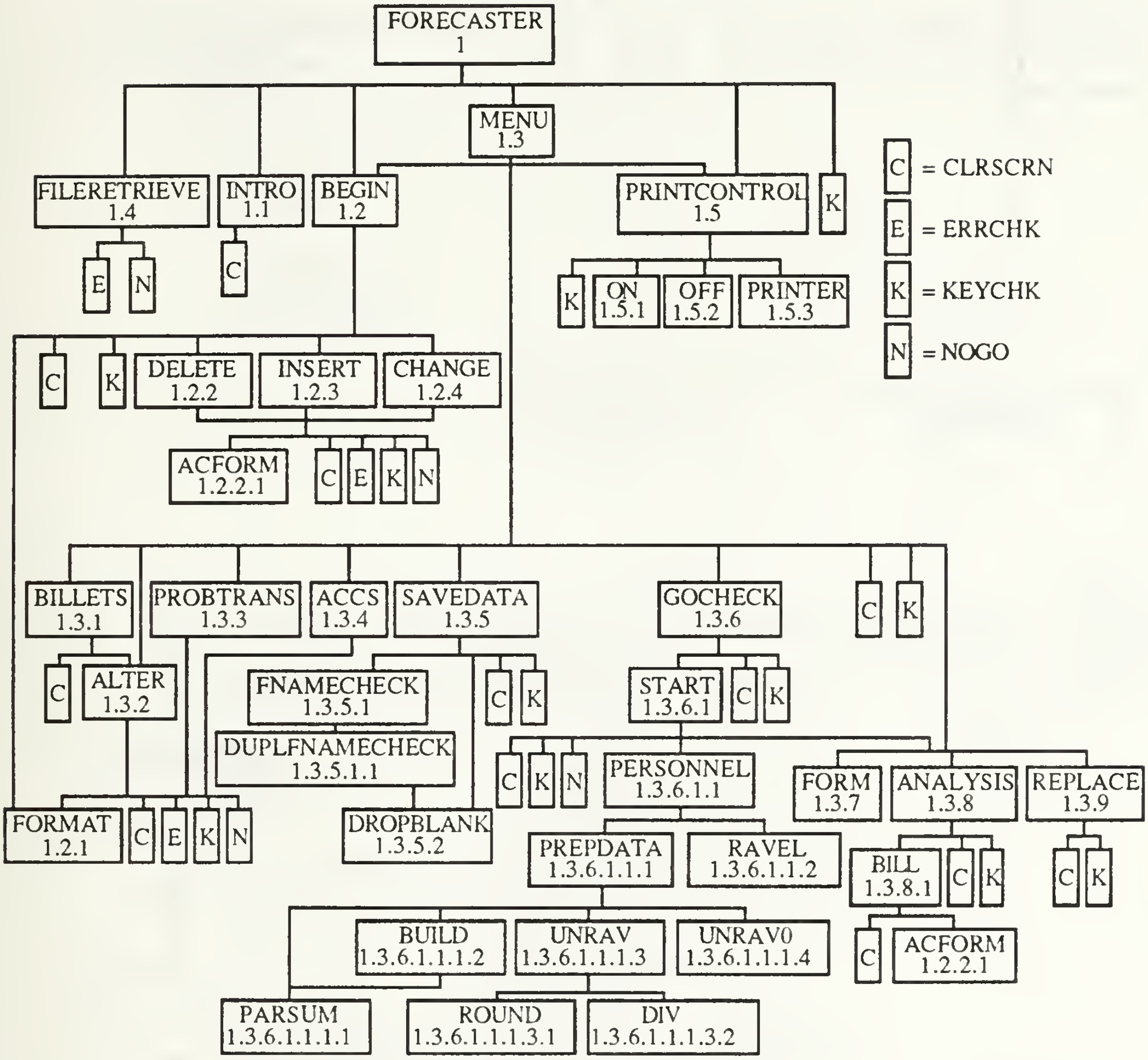
The FORECASTER program is a satisfactorily user friendly program which provides an excellent capability for conducting career path modeling and analysis. During the development of this thesis, two major model changes were made concurrently which resulted in a significant increase in the functionality of the program. These were modifications to the computational core which enabled the program to be run on a personal computer, and the ability to create, save and access multiple data sets.

C. RECOMMENDATIONS

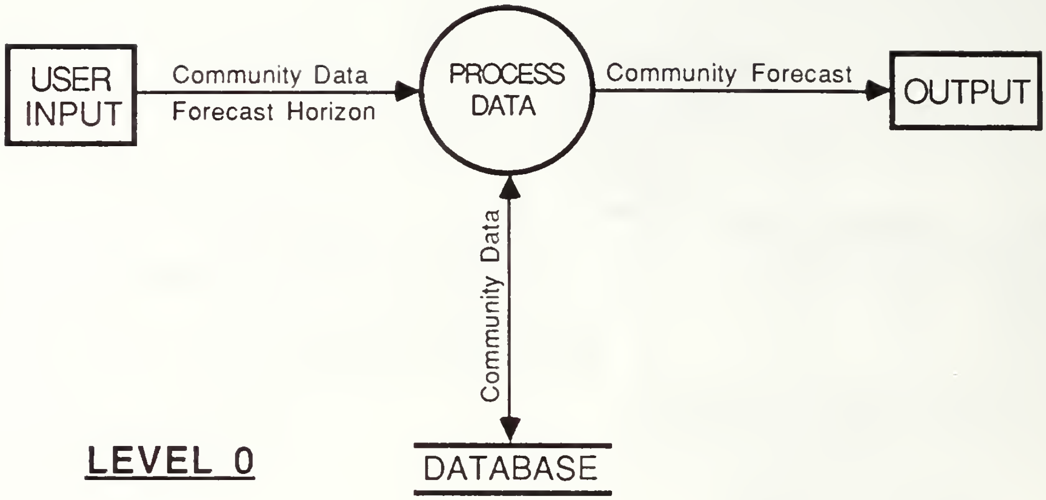
In April of 1988, the Government Accounting Office (GAO) produced a Congressional Briefing Report entitled *Proposals to Modify the Management of Officers Assigned to Joint Duty.*[Ref. 11] It had been generated partially in response to DoD legislative proposals to modify Title IV of the Goldwater-Nichols Act. In June, 1988, this report was supplemented by another, *Impact of Joint Duty Tours on Officer Career Paths*, in which the results of an analysis comparing the various lengths of time officers spent in "key war-fighting positions" (sea duty) and "non-war-fighting positions" (shore duty) were presented. The report goes into great detail to determine if an officer's career path has enough "non-war-fighting position" time to accommodate joint tours. It states that naval officers in field grades spend an average of 8.2 out of 16 years in "non-war-fighting positions" with the median continuous length of time as 2.6 years. Consequently, the conclusion is that there is enough time to do a 4.5 year JPME/JDA tour. <u>The report fails to address what effect this might have on community career path structures. It is the conclusion of this analysis that the overall effect within the TACAIR community will be a deterioration of warfighting skills of field grade officers, and a decreased ability within the community to fill soft billets.</u> Further analysis of TACAIR community data generated from fiscal year 1989 should be conducted to validate these conclusions and, if so, similar analyses should be conducted on other communities to determine if similar effects are present. Depending on the extent, the results should be reviewed by the DoD for consideration toward development and support of additional legislative proposals to modify title IV of the Goldwater-Nichols Act. [Ref. 12]

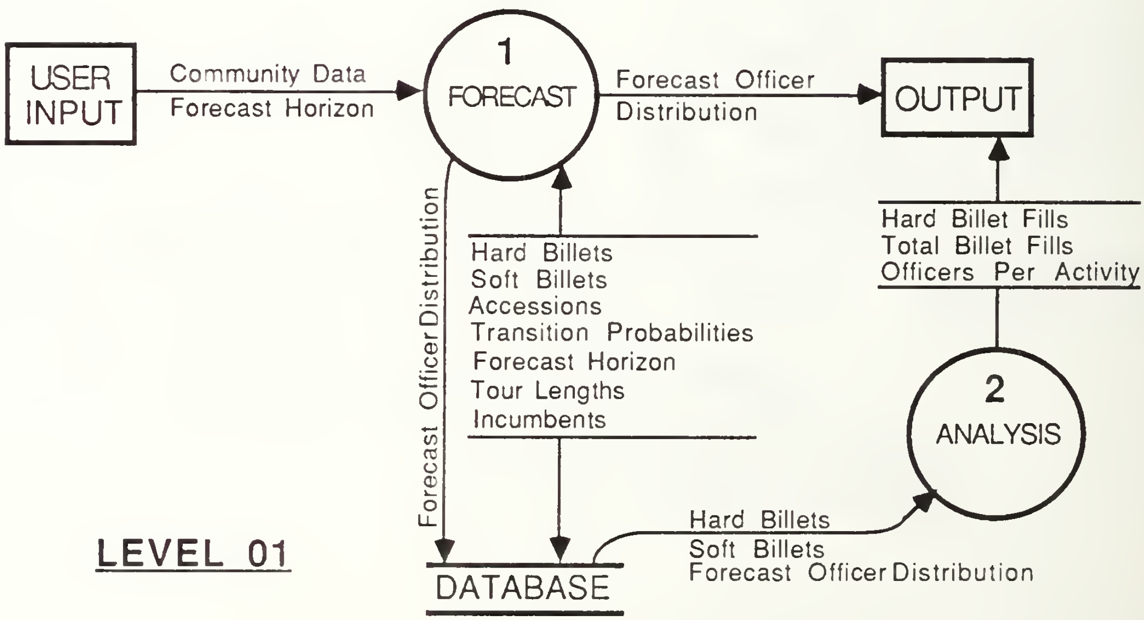
Specific recommendations have also been developed for improvement of the FORECASTER program. First, the capability of producing a printed report should be improved to provide the user the option of selecting specific data sets and/or results. Second, user capabilities in data set editing should expanded. Finally, consideration should be given to expanding the model by providing it with the capability to model a community which contains two or more sub-communities.

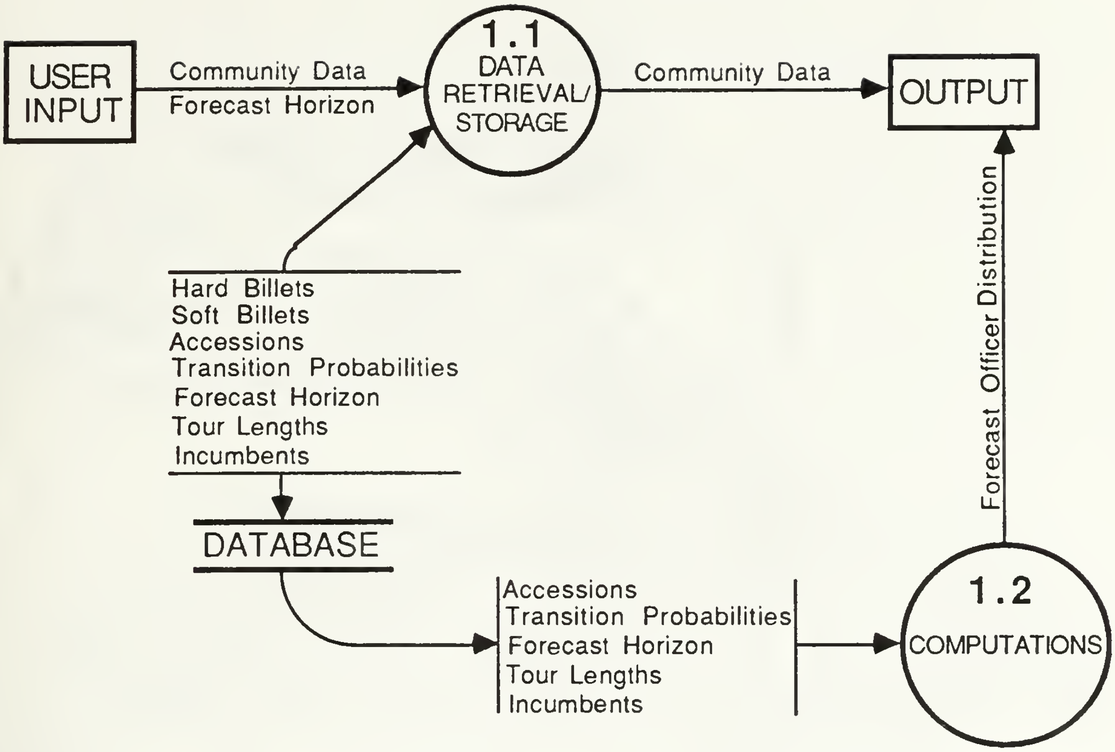
APPENDIX A
FORECASTER FUNCTIONAL HIERARCHY



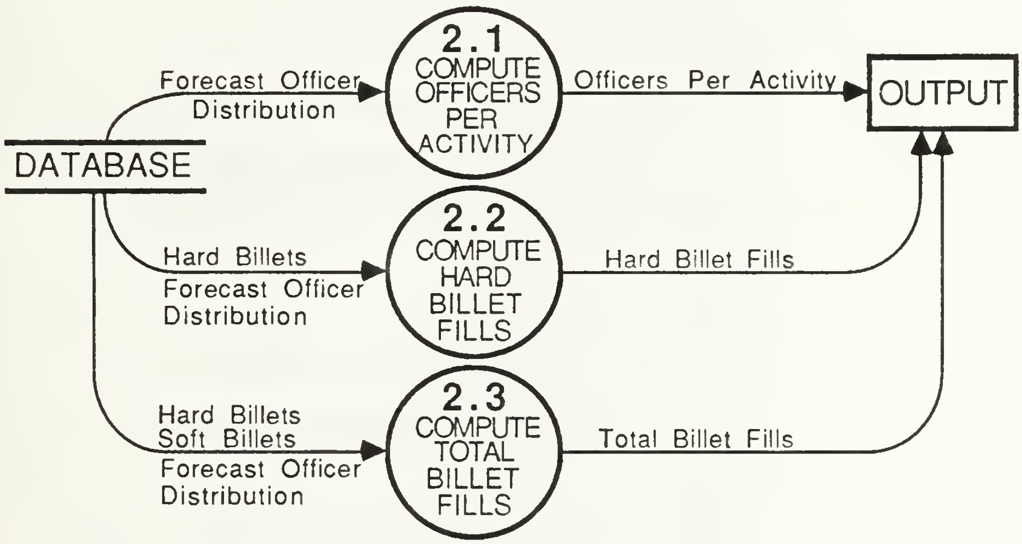
APPENDIX B
DATA FLOW DIAGRAMS





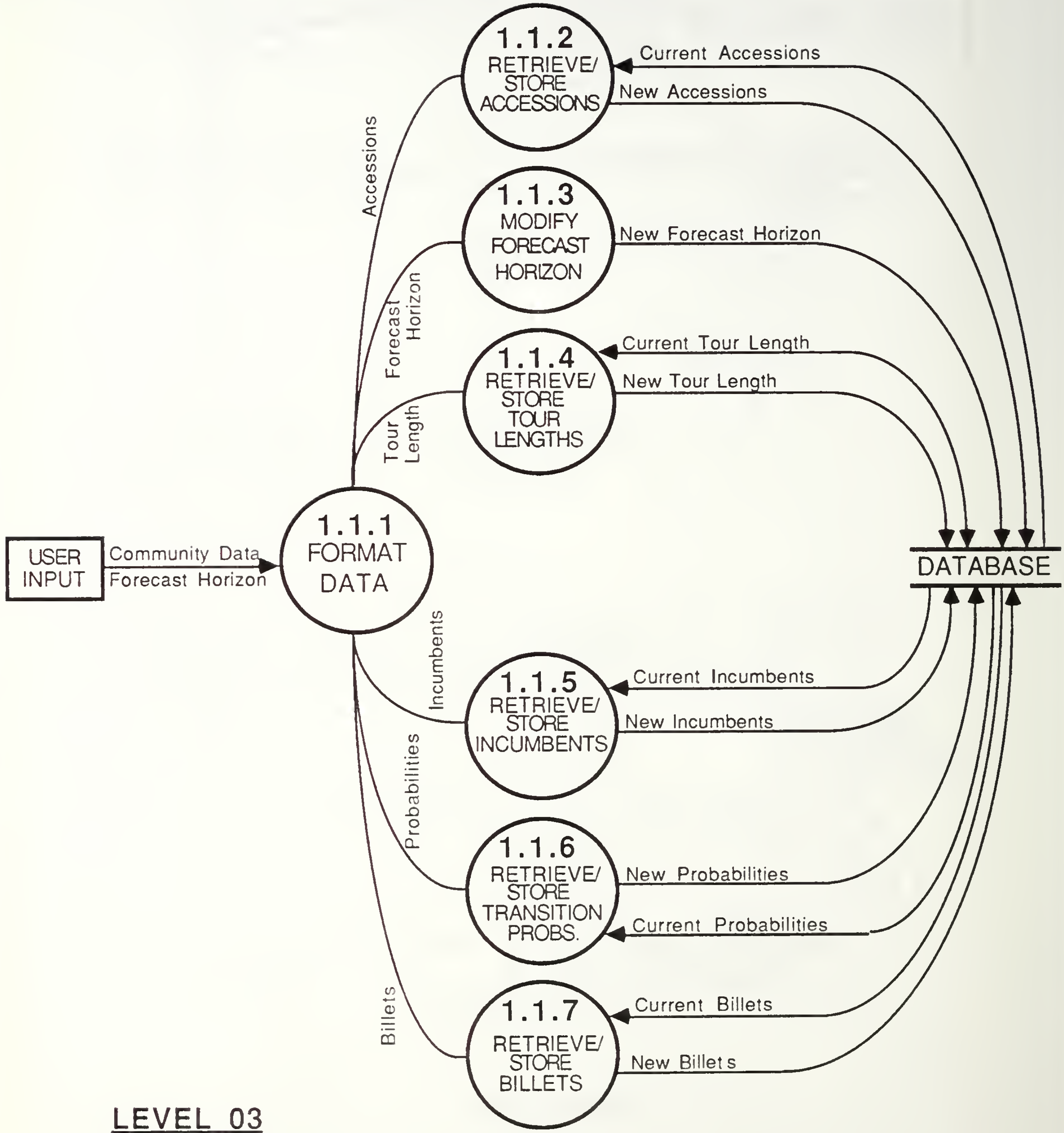


USER INPUT
Community Data
Forecast Horizon
1.1
DATA RETRIEVAL/ STORAGE
Community Data
OUTPUT
Forecast Officer Distribution
Hard Billets
Soft Billets
Accessions
Transition Probabilities
Forecast Horizon
Tour Lengths
Incumbents
DATABASE
Accessions
Transition Probabilities
Forecast Horizon
Tour Lengths
Incumbents
1.2
COMPUTATIONS



DATABASE
Forecast Officer Distribution
2.1
COMPUTE OFFICERS PER ACTIVITY
Officers Per Activity
OUTPUT
Hard Billets
Forecast Officer Distribution
2.2
COMPUTE HARD BILLET FILLS
Hard Billet Fills
Hard Billets
Soft Billets
Forecast Officer Distribution
2.3
COMPUTE TOTAL BILLET FILLS
Total Billet Fills

LEVEL 02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Forecast Horizon
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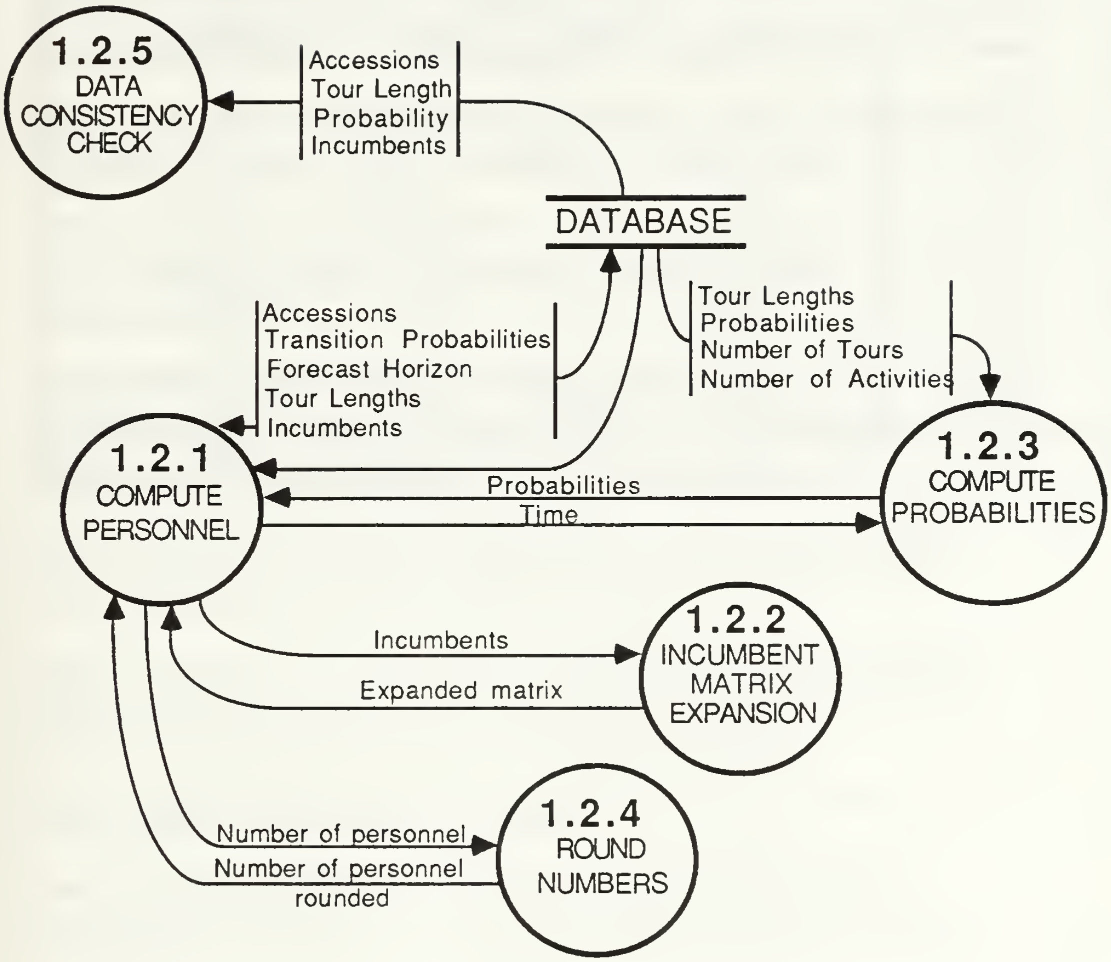
Accessions
Forecast Horizon
Tour Length
Incumbents
Probabilities
Billets
1.1.2 RETRIEVE/ STORE ACCESSIONS
Current Accessions
New Accessions
1.1.3 MODIFY FORECAST HORIZON
New Forecast Horizon
1.1.4 RETRIEVE/ STORE TOUR LENGTHS
Current Tour Length
New Tour Length
1.1.5 RETRIEVE/ STORE INCUMBENTS
Current Incumbents
New Incumbents
1.1.6 RETRIEVE/ STORE TRANSITION PROBS.
New Probabilities
Current Probabilities
1.1.7 RETRIEVE/ STORE BILLETS
Current Billets
New Billets
DATABASE

LEVEL 03


1.2.5
DATA
CONSISTENCY
CHECK
Accessions
Tour Length
Probability
Incumbents
DATABASE
Accessions
Transition Probabilities
Forecast Horizon
Tour Lengths
Incumbents
Tour Lengths
Probabilities
Number of Tours
Number of Activities
1.2.1
COMPUTE
PERSONNEL
Probabilities
Time
1.2.3
COMPUTE
PROBABILITIES
Incumbents
Expanded matrix
1.2.2
INCUMBENT
MATRIX
EXPANSION
Number of personnel
Number of personnel
rounded
1.2.4
ROUND
NUMBERS

LEVEL 03

APPENDIX C
TACAIR ATTRITION RATES FOR 1986 TO 1988

RANK	YEAR			
	1986	1987	1988	AVERAGE
ENS	1	0	0	1
LTJG	7	8	12	9
LT	205	238	282	242
LCDR	139	82	83	101
CDR	92	98	130	107
CAPT	88	64	63	72
TOTAL	532	490	570	531
OMF	516	472	596	528

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